near the walls could be measured by couples made from 10 per cent. alloys of iridium and rhodium with platinum; the author estimated that the maximum temperature at the place of measurement was between 1850° and 1900° C.

The business of the day concluded with a discussion on the principles of mechanical flight, opened by Prof. Bryan. As a matter of fact, owing to the line of argument adopted by the opener, there was practically no discussion on principles, but there was a somewhat heated debate as to the respective provinces of the mathematician, the physicist, and the engineer in solving the problems of mechanical flight. If the engineer is to wait until the mathematician has evolved a completely satisfactory theory as to the stability, &c., of aëroplanes, it is quite clear that little further progress will be made. The successful developments of most of the mechanical devices now employed by man have followed lines very different from those which seem good to Prof. Bryan; and mathematical theory has generally followed, and not preceded, the engineer's victory over the forces of nature.

The proceedings were opened on Tuesday, September 6, by a paper by Prof. Coker on the optical determination of stress. Prof. Coker has been working for some time at this problem, utilising the well-known fact that glass is rendered doubly refractive by stress; as glass, however, owing to the difficulty of obtaining suitable pieces free from initial strains, has proved unsuitable, the author has fallen back on the use of xylonite, which answers admirably. The apparatus necessary included an arc lamp to supply the beam of light, and lenses and prisms. The author showed a number of lantern-slides of the permanent records he had obtained by making use of Lumière colour plates.

Prof. Dalby then read his paper on the measurement of the air supply to a gas-engine cylinder; the air on its way to the engine flows through an orifice into a chamber, from which it passes to the suction valve; the engine is fitted with an apparatus which enables the temperature corresponding to the pressure and volume at an assigned crank angle to be measured, and thus all the data required for calculating the weight of air passing through the orifice per second are accurately known.

Prof. S. P. Thompson next read a paper on the laws of electromechanics; the author stated that his object was to put into concrete form the chief laws governing the performance of various electromagnetic mechanisms, and a number of formulæ was deduced.

Mr. F. Bacon then read his paper on heat insulation, in which he described his researches into the heat-insulating efficiency of a number of materials; the heat which was transmitted was produced electrically, and electrical methods were employed to measure the temperatures. In the discussion it was pointed out that in lagging steam-pipes there was with each material a definite thickness which it was uneconomical to increase, as the increase of external surface increased the radiation at a greater rate than the increased thickness diminished it.

The last paper of the day was by Prof. E. Wilson and Mr. W. H. Wilson on a new method of producing high-tension electrical discharges. In this method energy is taken from an alternating or continuous current source, and is stored in a magnetic field by inductance; it is then allowed to surge into a condenser, which together with the inductance forms a low-frequency oscillatory circuit. When the energy has accumulated in the condenser, the condenser is mechanically bridged across the primary winding of an induction coil, with which it forms a high-frequency oscillatory circuit. The energy is then transmitted by the secondary winding of the induction coil to the work circuit, and may be either oscillatory or unidirectional. The apparatus is suitable for radio-telegraphy or any work employing high-tension electricity.

The concluding meeting of the section was held on Wednesday, September 7, when the first paper was one by Mr. R. W. Weekes on self-raising rollers for maps and plans, descriptive of an ingenious arrangement for mounting plans, maps, and diagrams.

The next paper was entitled "Machine for Testing Rubber by Means of its Mechanical Hysteresis," by Prof. Schwartz. The author had designed a machine in which a specimen of rubber of standard dimensions was loaded at a given rate to a given percentage of the maximum load. The load was then gradually removed, and a complete stress-strain diagram automatically taken; as rubber possesses very considerable mechanical hysteresis, the stress diagram was of a loop form; from this the chief physical characteristics of the sample could be readily deduced.

Prof. Fessenden then gave his paper on the utilisation of solar radiation, wind power, and other intermittent natural sources of energy. The author estimated that the total first cost of the solar plant per horse-power would be about 20*l*., and the annual charge about 30*s*. per horse-power; he stated that a plant of 3000 horse-power was at present in course of erection. In the discussion Sir William White expressed the view that in all these schemes for the working of intermittent sources of energy the cost of works of construction generally proved prohibitive.

The last paper was by Mr. Cook on an experimental investigation of the strength of thick cylinders. The author described his investigations into the strength of cast-iron and mild steel thick cylinders when subjected to gradually increasing internal pressure up to the bursting point. Mr. Cook had found in the case of the mild steel cylinder that the tensile stress at the yield point, as calculated by Lamé's equation, agreed closely with the value of the tensile stress at the yield point in an ordinary tension test of the steel.

The proceedings closed with votes of thanks to the president and secretaries of the section.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BRISTOL.—The first congregation for the presentation of degrees in the University of Bristol was held on October 20 before a crowded assembly. Owing to failing health, the Chancellor, Mr. H. O. Wills, was not present, and his place was filled by the Vice-Chancellor, Sir Isambard Owen. The degree list was a long one, as besides the ordinary graduating students there were fifty-two old students of University College and the Merchant Venturers Technical College, who, having taken degrees in other universities, were admitted to *ad eundem* degrees in the University. In a few special cases, also, degrees of Bachelor were awarded to associates of these institutions. Only one honorary degree was conferred, and that, the Doctorate of Science, on Prof. Conwy Lloyd Morgan, F.R.S., lately Vice-Chancellor of the University and sometime principal of University College, Bristol. He was introduced by Prof. F. R. Barrell, dean of the science faculty, who in the course of his address said:—"Expert in knowledge of the fossil past, expert in knowledge of the living present, he stands renowned in varied fields of thought; keenly has he observed, acutely has he analysed the workings of the mind in man and bird and beast; at his behest the artless infant and the unfeathered chick alike disclose the secrets of their nascent reason; psychology, zoology, geology, all acknowledge in him a master. A teacher of teachers, he has o'erstepped the boundaries of this isle; in southern Africa he has dwelt and taught; not once or twice alone has he been called across Atlantic seas to inform the wisdom of the West. With fertile pen and with lucid speech he has made clear the subtle mazes of philosophy; his written word is read where'er the English language penetrates, and done into the German tongue it guides the Teuton in the study of nature."

CAMBRIDGE.—Mr. A. E. Shipley, F.R.S., fellow and tutor of Christ's College, has been elected master of the college in succession to the late Dr. John Peile.

Dr. Tempest Anderson will deliver a lecture in the Sedgwick Museum on "Matavanu, a New Volcano in Savaii, German Samoa," illustrated with lantern photographs, on Saturday, November 5, at 5 p.m.

The Henry Sidgwick memorial lecture, to be given by Sir George Darwin, K.C.B., F.R.S., on "William and Caroline Herschel," will take place in the hall of Newnham College at 5 p.m. on Saturday, December 3, instead of November 12, as previously announced.

IT is stated in *Science* that the Tuskegee Institute will receive about 80,000*l*. from the estate of Mrs. Dotger, and

the Hampden Institute will receive about 50,000*l.* from the estate of Miss Alice Byington. By the death of Mrs. Loomis, the estate of the late Colonel John Mason Loomis, amounting to more than 200,000*l.*, will, it is said, go to the establishment of a technical school at Windsor, Conn.

THE College of the City of New York has acquired, says *Science*, the complete private library of the late Prof. Simon Newcomb, consisting of about 4000 volumes and 7000 pamphlets dealing with astronomy, mathematics, and physics. Both pamphlets and books are being catalogued, and are now accessible to research students, in accordance with the expressed desire of Prof. and Mrs. Newcomb.

ON October 22 Mr. T. Fenwick Harrison laid the foundation-stone of new engineering laboratories for the University of Liverpool. The cost of the building will be met by a gift of 35,000*l.* received from Mr. Fenwick Harrison, Mr. J. W. Hughes, and Mr. Heath Harrison. Prof. Watkinson thanked Mr. Harrison for laying the foundation-stone, and in the course of his remarks said it is intended to make special provision for teaching and research work in connection with all branches of engineering, internal-combustion engines, steam turbine engines, refrigeration, and fuel testing, and in this respect the laboratories will be second to none in the kingdom. The donors intend that the subject of heat engines, and particularly of internal-combustion engines, shall be developed on a much more important scale than has been hitherto attempted. As shipowners who use three hundred thousand tons of coal a year they see the advantages to be derived from the successful application of the internal-combustion engine, so far as ships are concerned, for it means the reduction of coal consumption to one-half, and possibly to one-third, of that now required for steam engines. It is humiliating, said Prof. Watkinson, that the names associated with the invention of internal-combustion engines are almost without exception German, and nearly all the internal-combustion engines being built to-day in this country are being built under licence from Germany. Greater scientific knowledge is required than in the design of steam engines, and it is reasonable to conclude that the greater success of the Germans is due to their better training in scientific principles. Last year Prof. Watkinson visited all the principal schools of engineering in the United States and in Canada, and in nearly every one he found that their gigantic laboratories were being greatly extended. Both the Germans and the Americans realise far more than we do in this country the value of a university training, and they also realise that in this age, when machinery plays such a large part in almost every industry, that this training is the best for those who are to control and direct most of the great industries. That is well illustrated, said Prof. Watkinson, by the fact that there are about 17,000 students taking a four years' course in the American schools of engineering, which is about eight times the number of students taking the normal three years' course in this country.

THE introductory address at the London School of Tropical Medicine was this year delivered by Dr. Henry A. Miers, F.R.S., principal of the University of London. The subject of the address was scientific observation, and Dr. Miers directed attention to an aspect of scientific research and of training in scientific investigation which, he said, seemed in danger of escaping notice. Under present conditions scientific research is seldom pursued save by those whose object is clear and whose minds are concentrated upon a special line of investigation in which they are alive and alert to the exclusion of any distracting side-issues. Each new discovery is pursued with ever-increasing rapidity and with a system which is fruitful in results; the searchlight of investigation is turned with mechanical precision upon every new problem, and it would appear unlikely that anything of importance should be overlooked. But teachers and investigators do not sufficiently bear in mind two possible dangers that beset them under modern conditions of work. It is inherent in our senses and our intelligence, first, that those whose attention is too minutely fixed upon one thing will fail to perceive other things which are equally discernible and equally important; and, secondly, that those who look or listen too intently for a thing may actually see or hear that which they desire, even though it be not there. Later in his address Dr. Miers gave it as his opinion that, taken as a whole, scientific men are not better general observers than other people, though some among them undoubtedly are. It has been too often assumed that scientific training has a special value as developing the general powers of observation, and that because students have been exercised in special observations they have become practised observers of things in general, whereas the reverse may be nearer the truth, and in many instances certainly is so. Some practice in all-round observation should be incorporated in the training of the specialist if we are to have our students quick to observe details that do not form part of their conscious exercises; neither should they be led to suppose that, because they have been practised in observing one thing, they are therefore good observers of everything else. To him who has eyes to see, the most trivial detail may be the germ of an important discovery. Our laboratory training gives the student his eyes, but does not always teach him to use them widely or wisely.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, October 10.—M. Émile Picard in the chair.—The president announced the death of M. Treub, correspondant in the section of botany, and of Ernst von Leyden, correspondant in the section of medicine and surgery.—Henri **Douvillé**: The formation of the loam of the plateaux. This loam, consisting of a very intimate mixture of clay and fine sand, is well developed in the neighbourhood of Paris and in the north of France. Two hypotheses have been put forward to explain its formation, deposition from water and transport by wind. The former hypothesis is shown to be in better accord with the observed facts; to explain the height above the sea at which these deposits are found, the floods carrying the deposits are supposed to have been caused by the sudden melting of snows, the lower portion of the valley being blocked by glacier.—Serge **Bernstein**: A generalisation of the theorems of Liouville and Picard.—F. **Robin**: The law of resistance to crushing of cylindrical bodies as a function of their dimensions. The general law of resistance to crushing as a function of the dimensions of the test-pieces is expressed geometrically by a hyperbolic paraboloid.—H. **Pelabon**: Batteries with antimony and antimony selenides. An element formed of antimony and antimony selenide, with an acid solution of antimony trichloride as the electrolyte, shows varying electromotive force under the action of light. If sulphur or tellurium is substituted for the selenium the phenomena described are not produced. The effect is strongest when the element is exposed to the yellow and red rays.—G. **Charpy** and S. **Bonnerot**: The reduction of oxide of iron by solid carbon. Ferric oxide and graphite, intimately mixed, were heated in a vacuum at temperatures up to 950° C., and the reaction studied by measuring the amount of gas evolved per hour. The speed of reaction diminished as the pressure maintained in the apparatus was reduced, and became practically zero when the pressure in the tube was of the order of 0·001 mm. of mercury. Hence it is concluded that solid carbon does not reduce oxide of iron at 950° C.—P. **Mahler** and J. **Denet**: The presence of a small quantity of carbon monoxide in the air of coal mines. The amounts found varied between 0 and 40 volumes per million, with an average of 19. The maximum amount of carbon monoxide corresponded with the minimum of methane, and the maximum methane was found in the sample containing no carbon monoxide.—Paul **Vuillemin**: A natural preventative to the oak-tree disease. The disease of the oak, caused by an Oidium, is kept in check by a Cicinnobolus, a parasite preventing the multiplication of the Oidium by conidia, and its preservation by the mycelium.—E. L. **Trouessart**: The mammalian fauna of Europe.—Ch. **Gravier**: The coral reefs of the Gulf of Aden and their madrepores.—Paul **Marchal**: Contributions to the biological study of Chermes.—Edouard **Chatton**: The exist-